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Lock

The invention relates to a lock with a bolt arranged in a lock housing, wherein the bolt can be shifted between an opened and a closed position by means of a closing element, wherein in the closing position the closing element can be blocked by means of a blocking element, and wherein the blocking element is coupled with an armature of an electromagnet and can be actuated by the latter.

Such a lock is known from USP 1,721,730. There, the electromagnet is coupled to a lever mechanism by means of an armature. The lever mechanism supports the blocking element. A push bar lock can be released or blocked by means of the blocking element. The danger of unauthorized manipulation exists with such locks. In accordance with this it is possible to shift the armature of the electromagnet from the outside of the locked door by means of a strong permanent magnet. This is possible in particular in connection with rare earth magnets, which build up a strong magnetic field. If the armature has been brought out of engagement with the locking element in this way, it is then possible to open the door.

It is the object of the invention to produce a lock of the above mentioned type, which offers increased protection against unauthorized manipulation.

This object is attained in that the armature and/or the electromagnet are covered, at least over portions, by means of at least one shielding element made of a low-retentive magnetic material arranged on or in the housing.

The shielding element made of a low-retentive magnetic material, for example iron, bundles the magnetic field emanating from the magnet employed for the manipulation. In

this way the armature and/or the electromagnet are protected in a simple manner. Because the shielding element is directly associated with the housing, no additional installation outlay for shielding is created in the course of assembling the lock.

In accordance with a preferred embodiment of the invention it is provided that the housing has a connecting side, on which lock operating elements (keypad, grille) are arranged, and that the shielding element is arranged in the area of the housing facing the connecting side. With its connecting side the lock can be installed on the inside of a door of a locker, for example. This connecting side is protected against the interfering action.

A structurally simple lock design results if it is provided that the housing is closed by means of a cover, and that the cover supports the shielding element on its side facing the housing interior.

In order to be able to achieve effective shielding even against very strong magnets, it can be provided that the shielding element is constituted by a sheet metal plate whose wall thickness is at least 0.8 mm. The shielding element can also be directly installed on the electromagnet for achieving effective protection.

An additional function is assigned to the armature, if it is provided that the armature or the blocking element supports a switching element which actuates a contactless switch. The contactless switch therefore can monitor the blocking state of the blocking element. Because of the employment of a contactless switch, no or only slight switching forces for the performance of the switching process are created. Accordingly, the electromagnet need not be provided any additional switching power, so that it can be

operated with a low output of energy. This has a positive effect, in particular if a battery-generated current supply is used for the lock.

In this case it can be provided in particular that the armature or the blocking element has a permanent magnet as the switching element, by means of which a change of the switching state of the contactless switch, which is embodied as a reed contact, can be performed. To prevent unauthorized influencing of the reed contact, the latter can be arranged in the area of the shielding element.

A possible lock variation can be distinguished in that a permanent magnet which maintains the armature in its opening state is assigned to the armature, that a magnetic force which acts counter to the force of the permanent magnet can be applied to the armature by means of the electromagnet, and that a spring is assigned to the armature which, in the open state, applies a spring force acting on the armature in the closing direction. By means of this lock layout it is possible to employ an electromagnet acting in one direction, which makes possible a low energy requirement.

The invention will be explained in greater detail in what follows by means of an exemplary embodiment represented in the drawings. Shown are in:

Fig. 1, a lock in a lateral view along the section line represented in Fig. 2,

Fig. 2, the lock in accordance with Fig. 1 in a view from above,

Figs. 3 to 6, flow diagrams representing the procedure for operating the lock.

A lock with a housing 10 is shown in Fig. 1. The housing 10 has a bottom 11, from which lateral walls 11 arise all around. At the top shown in Fig. 1, the housing 10 forms

a connecting side. There, the housing 10 is closed off by means of a screwed on cover 20. As revealed in Fig. 2, the housing 10 has two fastening flanges 13 with fastening receivers 13.1 on the sides of the cover 20. By means of these the lock can be screwed on the inside of a door, flap or the like, for example.

The cover 20 has a ring-shaped rose holder 24, which surrounds a keypad field. A keypad 26, for example a silicon switching plate, is fastened to the rear of the cover 20. It protrudes with its keys through openings in the cover 20. Also, at least one LED 26.2, which indicates the operational states of the lock, is assigned to the keypad 26. Furthermore, a line jack 26.1 is integrated into the keypad 26. By means of this, the presently battery-powered lock can be provided with electrical current if the battery fails. The line jack 26.1 is advantageously integrated into the silicon switching plate as a predetermined breaking point. In case of need, a plug can be pushed through the predetermined breaking point and electrical current can be supplied externally. Following the removal of the plug, the created hole seals itself because of the inherent elasticity of the created hole. A removable compartment cover 16 is provided on the side of the lock facing away from the connecting side. It covers a battery compartment 14, in which the batteries for providing the lock with electrical current are maintained. A rose 25 has been pushed onto the rose holder 24 shown in Fig. 1. The rose holder 24 protrudes into an opening of the connected door. The rose 25 is inserted from the front of the door. It covers the edge of the opening with its radially protruding flange.

A support section 23, which extends annularly and surrounds a bearing receiver 21 of the cover 20, has

furthermore been formed on the cover 20. A rose 22 can be pushed on a handle 30. Then the rose 22 is arranged above the support section 23. The rose 22 is used for covering an edge of a circle-shaped opening in the door, through which the handle 30 has been passed. The rose 22 is continuously adjustable in respect to the handle 30 in an assigned bore receptacle of a door, and the rose 25 on the rose holder 24, so that matching of different door thicknesses can be provided.

The handle 30 is connected with a locking element 40. The handle has been inserted with a plug-in shoulder 32 into a plug-in receptacle 45 of the locking element 40. The locking element 40 has a screw receptacle 42 which is aligned with a threaded receiver 31 of the handle 30. A screw can be passed through the screw receptacle 42 and screwed into the threaded receiver 31.

The locking element 40 is rotatably maintained with a first bearing shoulder 43 on a bearing 15 of the housing 10, and with a second bearing shoulder 44 in the bearing receiver 21 of the cover 20. The locking element can be rotated around the bearing axis, which extends vertically in Fig. 1.

The locking element 40 is in engagement with a bolt 46. The latter can be moved between an opened and a closed position in a slide guide of the housing 10 by means of the locking element 40. Fig. 1 shows the opened position with the bolt 46 retracted. In Fig. 2 the bolt 46 has been extended from the housing 10.

As Fig. 1 shows, the locking element 40 is provided with an arresting receptacle 41, which is arranged in the form of a radially accessible recess in the area of the bearing shoulder 43. A blocking element, which is a part of an armature 51 of an electromagnet 50, is assigned to the

arresting receptacle 41. The electromagnet 50 is maintained in the housing 10 and can be activated by means of the battery. The electromagnet 50 pushes the armature 51 out and, from the opened position shown in Fig. 1, it reaches the blocking position, in which the blocking element 52 engages the arresting receptacle 41. The electromagnet 50 is also equipped with a permanent magnet 53. In the currentless state of the electromagnet 50, it maintains the armature 51 in the initial position illustrated in Fig. 1. When the electromagnet 50 is activated, the armature 51 is pushed away from the permanent magnet 53. For reasons of saving electrical current, the electromagnet 50 is only briefly provided with electrical current. This is already sufficient for lifting it slightly off the permanent magnet 53. Then a spring 55, which prestresses the armature 51 in the closing position, pushes the armature 51 into the arresting receptacle 41.

The electromagnet 50 is surrounded by a hoop-shaped shielding element 54. This is made of a low-retentive magnetic material and provides shielding against magnetic radiation acting from the outside.

Fig. 1 further discloses that the armature 51 supports a permanent magnet 56. The latter, in the form of a ring, has been pushed onto the armature 51, which is round in cross section. A reed contact as a contactless switch 57, which is fastened on a plate 60, has been assigned to the permanent magnet 56. Together with the armature 51, the permanent magnet 56 can be moved between two positions. It then also moves the reed contact into different switching positions.

A further shielding element 58 is provided on the inside of the cover 20. It has been made in the form of a 1 mm thick plate of a low-retentive magnetic material. The

shielding element 58 shields the armature 51 in the transition area to the electromagnet 50 and prevents the effects of magnetic radiation from the direction of the connecting side. The plate 60 receives the electric switching devices of the lock. It receives the reed contact, a micro-controller and the switches which can be actuated by the keys of the keypad 26.

In what follows, the operation and functioning of the lock will be explained in greater detail by means of Figs. 3 to 6.

The procedure for closing the lock is explained in greater detail in Fig. 3. In accordance therewith, first the handle 30, and with it the locking element 40 is rotated. In the course of this, the arresting receptacle 41 is assigned to the blocking element 52. Subsequently it is possible to input a code, limited to a specified number (for example with four digits), which had been freely selected by the user. This can be acknowledged by means of a locking key of the keypad 26.

The control circuit arranged on the plate 60 is triggered via the locking key, so that it activates the electromagnet 50 by means of a short electrical current pulse. As described above, the latter pushes the armature 51 away from the permanent magnet 53. Then the spring 55 pushes the armature 51, together with its blocking element 52, into the arresting receptacle 41. As shown in Fig. 3, two control stages (small diamond-shaped boxes) have been programmed. These check whether the locking key had been actuated within a pre-specified time window, and whether the code is admissible. In addition, the reed switch checks whether the armature 51 had been switched into the closed position. Only then is the code dependably stored. Fig. 4 describes the

process for opening the lock. Accordingly, the code pre-specified in accordance with Fig. 3 is entered and an opening key is then pushed. If the opening key is actuated within a pre-specified time window and the correct code has been entered, the memory of the control circuit is released for the renewed entry of a code after an acknowledgement signal has been issued. The opening key simultaneously activates an electrical circuit in the control circuit, which activates the electromagnet 50 in such a way that the armature 51 is moved out of the arresting receptacle 41. In the process, the armature 51 is moved counter to the force of the spring 55 against the permanent magnet 53 and is then held by it. This position is represented in Fig. 1. If the armature 51 does not move back correctly (for example, because the lock is jammed), the user can again operate th opening key. In the course of this an extended electrical current pulse is applied to the electromagnet 50. The reed contact (contactless switch 57) signals that the mechanism has been unlocked. Then the lock can be unlocked by means of the handle 30. For this purpose the handle is rotated so that the bolt 46 enters the housing 10.

Fig. 5 shows the procedure for opening the lock by means of a master code. As the representation shows, the sequence has been selected analogous to the routine represented in Fig. 4. A flow diagram is shown in Fig. 6, which shows the procedure for re-programming the master code. Changing the master code is possible in the opened, as well as in the locked state of the lock.

So that the lock can also be opened if the master code has been lost, the control circuit can be set as a freely definable handling code.

For making optimum use of the life of the batteries,

the lock has an energy circuit. It is activated if the lock is not operated within a pre-specified time window. Switching from the economy mode into the operating mode takes place as soon as a key of the keypad 26 has been actuated.